

Deployed Flight Test of the Iraqi Air Force Comp Air 7SLX (CA-7)



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Edwards Air Force Base, California**

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Foreword

Having led the 412 Test Wing during the deployed test of the Iraqi Air Force Comp Air 7SLX (CA-7) in 2006, I assure the reader the story of this project illustrates the tremendous capability of our test enterprise. The evaluation team included individuals from across AFMC who overcame exceptional challenges in a combat situation to test a unique airplane. How many can say they have experienced a co-pilot say “Your airplane,” as he gives you control and hands you the broken throttle.

We depend on the expertise of our test professionals to accomplish our mission. Our investment in their training, which includes the classic flight test techniques in the United States Air Force Test Pilot School curriculum, paid off in Iraq in 2006 and continues to pay dividends to the Air Force today.

The Comp Air team eventually made the tough call to ground the CA-7 aircraft. Because of the professionalism and technical expertise demonstrated by the team during the test program, the grounding decision was supported by not only me but also all of our Senior Leaders. They had proven their mettle.

This story reflects what the developmental test and evaluation enterprise team can do whenever and wherever they are called upon. I say reflects as this is just one example of many we can share regarding unique warfighter support. I’m proud of the CA-7 team and the work of the men and women of the Air Force Test Center today.



ARNOLD W. BUNCH, JR.
Major General, USAF
Commander, Air Force Test Center

In 2005 and 2006 the Air Force Flight Test Center (AFFTC) evaluated the Comp Air 7SLX (CA-7) aircraft in support of U.S. Central Command and the Iraqi Air Force. While deployed to Kirkuk Air Base (AB), Iraq, personnel from AFFTC and 412th Test Wing (412 TW) at Edwards Air Force Base (AFB), California, and other units assigned to Air Force Materiel Command (AFMC) faced hardships and dangers not usually encountered in flight test, as well as fundamental problems in accomplishing the project in a combat zone. As 412th Operations Group (412 OG) deputy commander Lieutenant Colonel David Nils Larson observed, there was “no such thing as combat flight test.” A U.S. Air Force pilot could log a combat sortie or a flight test sortie, not both simultaneously. Combat flight test was ultimately what the CA-7 project became.¹



An Iraqi Air Force Comp Air 7SLX touches down on the main runway at Edwards AFB after successfully completing its initial flight test April 25, 2006. A combined team from Edwards, Robins Air Force Base, Georgia, Hill AFB, Utah, and Tinker AFB, Oklahoma, spent two months rebuilding the aircraft. (USAF photo by Jet Fabara)

The United Arab Emirates (UAE) provided seven CA-7 aircraft to the Iraqi Air Force in 2004. As an experimental

aircraft, also known as a homebuilt or kitplane, the CA-7 was built from a kit provided by the manufacturer, Aero Comp Inc., which customarily built no more than 49 percent of the kitplane. Their customers completed the rest. The high-wing, six-seat composite aircraft was powered by a Walter M601 657 horsepower turboprop engine. The engine, manufactured in the Czech Republic, was similar in design to the Pratt and Whitney PT6. The aircraft was configured with an after-market tricycle landing gear fitted with the nose strut from a Cessna 310. The UAE had made numerous other modifications.²

The United States Central Command Air Forces (CENTAF) was working with the Iraqi government to reestablish an air force in 2005. The CA-7 could satisfy part of that requirement. The aircraft had been grounded following a fatal mishap on May 30, 2005.³ Because the aircraft was not a U.S. asset, the Department of Defense lacked the statutory authority to convene an accident investigation board or to release an official opinion as to the cause of the accident. Brigadier General David W. Eidsaune, director of Air Component Coordination Element, Multi-National Force-Iraq, requested the assistance of AFMC in conducting limited flight test on the aircraft. CENTAF called for flight test professionals to help accomplish their objective with the CA-7 aircraft, on site, and in a hurry. CENTAF tasked AFMC on September 22, 2005, to evaluate the Iraqi Air Force's CA-7 aircraft. 412 TW granted the project test acceleration status the next day, which assigned the project a higher priority for resources at Edwards. Test objectives for the initial phase included conducting a limited evaluation of the stability, control, handling qualities, and performance of the Iraqi Air Force's CA-7s. AFFTC directed an initial team to evaluate the CA-7 in Iraq and recommend to AFMC and CENTAF how to proceed. CENTAF and AFMC subsequently tasked a second team to deploy to refurbish and restore the aircraft to their original design configuration.⁴

The CA-7 project comprised all the usual elements of a flight test program, including ground and flight test of the airframe, performance, flying qualities, and avionics. The program was highly visible, drawing the interest of the commander of AFMC,

General Bruce C. Carlson, and Air Force Chief of Staff, General T. Michael Moseley. Conducted on a shoestring budget and tight schedule, the project suffered from the constraints on schedule and cost most flight test programs experienced. Added to these challenges were a lack of necessary parts and equipment, as well as the hardships and dangers of an unfamiliar, potentially hostile environment. Perhaps most remarkable of all, it was conducted in a war zone. These challenges notwithstanding, an honest assessment of system performance was at the core of test and evaluation, particularly when the result was unpopular.

Phase I: Flight Test and Evaluation of the CA-7

Test pilot Lieutenant Colonel Mark P. “Forger” Stucky of the USAF Test Pilot School at Edwards AFB headed the first team constituted for the CA-7 flight test project. His team also included two flight test engineers. Major Vincent “Opus” Sei was a Test Pilot School instructor who also had experience building a kitplane of his own. The other engineer, Gregory W. Chaffee, came from the AFFTC Safety Office. Maintenance personnel included team lead Chief Master Sergeant William A. Ludwig, engine mechanic Dean M. van Oosterhout, and Lieutenant Colonel Andrew White, a pilot from AFMC. Robert Lee and Michael A. Golackson, both from the 412th Maintenance Group, and lead project engineer Fred Webster supported the project at Edwards AFB.⁵

Before deploying, this initial team completed training at the Aero Comp Inc. kitplane manufacturing facility in Merritt Island, Florida. Between October 3 and 5, 2005, they toured the production facility and accomplished 13 sorties to establish baseline flying and performance characteristics for the CA-7 aircraft.⁶

One of the last day’s familiarization sorties ended when project pilot Lieutenant Colonel Andrew White, with an Instructor Pilot from Aero Comp Inc. aboard, suffered an engine failure. Stucky had anticipated the possibility of an inflight emergency and as a former NASA civilian aerospace

research pilot had arranged for crash and fire support from the nearby Kennedy Space Center. Shuttle landing runway X68 was not usually available for operations of small aircraft, and Lieutenant Colonel Stucky promised NASA the CA-7 wouldn't land at Kennedy Space Center. Within a few minutes, however, the pilots declared mayday and advised the tower they were landing without engine power. Lieutenant Colonel Stucky landed his chase plane to help smooth things over. A heavily armed NASA security team immediately approached the aircraft. The Aero Comp Inc. pilot inexplicably decamped in the CA-7 that had had only moments before appeared unflyable, leaving Stucky and Sei to answer the security team's questions.⁷



Phase I test team from left to right: maintenance lead Chief Master Sergeant William A. Ludwig, AFMC test pilot Lieutenant Colonel Andy White, team lead Lieutenant Colonel Mark "Forger" Stucky, engine mechanic Dean van Oosterhout, and flight test engineers Major Vincent "Opus" Sei and Gregory W. Chaffee. (Photo courtesy of Dean van Oosterhout)

A smaller test team headed by Lieutenant Colonel Stucky then deployed from Florida directly to Kirkuk AB, Iraq, to

conduct an initial evaluation of the CA-7 aircraft between October 7 and 14, 2005.⁸

Flight test engineer Major Sei described the timeline for the first team's short-notice deployment as very compressed. "We needed to get smart about the airplane, come up with a test plan, go get training in the airplane, put together a whole instrumentation package," and complete test adequacy and safety reviews. The team members had to complete required pre-deployment training and immunizations within a week.⁹

Once in Iraq, Lieutenant Colonel Stucky and his team began inspecting the CA-7 aircraft on October 9, 2005, and found a number of serious issues. According to Major Sei, they discovered holes in the engine firewall and "positive pressure in the engine compartment." In his assessment, an engine fire "would have acted just like a blowtorch cutting into the crew compartment." Major Sei noted another disconcerting anomaly. The aircraft's original builder had used sheet metal screws drilled right into the fiberglass body of the aircraft without any nut plates or other support. Over time, the screws began to work their way out. "You'd hear things flapping on the outside of the airplane and realize things were coming off."¹⁰

On October 10, 2005, Lieutenant Colonel Stucky and Major Sei nevertheless began conducting flight test and evaluation sorties on the CA-7. Neither pilot had a high opinion of the Iraqi CA-7s. Lieutenant Colonel Stucky noted the CA-7 stalled without warning and had excessive speed stability. "If you added power," he explained, "the nose would just go way up." The aircraft "had a really slow trim system which ... would exceed your capability to push forward on the stick and keep it in control." As a consequence, the CA-7 "had a really nasty stall." Major Sei agreed, describing the aircraft as having "horrible flying qualities." On one of their first sorties, Major Sei contended that Stucky had not flown a test point successfully. Stucky invited Sei to try it himself. Because of the poor handling qualities of the CA-7, accepting the challenge was easier than carrying it out. "In short order," Lieutenant Colonel Stucky later reported, Major Sei "was wrestling with

the stick so badly that he looked like he was trying to choke a gorilla.” Major Sei abandoned the attempt to fly the test point.¹¹

Lieutenant Colonel Stucky and Major Sei agreed after their preliminary assessment that the CA-7 was unsuitable for continued use. According to Lieutenant Colonel Stucky, they enumerated the required repairs on the CA-7s, “but our overall recommendation was don’t fly these again. You’re just throwing good money after bad.” Major Sei believed that attempting to “make the Comp Air safe and effective wasn’t worth the time and money.” In addition, he suggested, “There were a lot of other cheaper, safer options, especially for high-tempo combat operations, airplanes that we could have substituted as opposed to trying to save the Comp Airs.”¹²



Phase I team members Major Vincent “Opus” Sei in the background and Lieutenant Colonel Mark “Forger” Stucky in the foreground in the cockpit of the CA 7 at Kirkuk AB, Iraq. (Photo courtesy of Dean van Oosterhout)

Having completed 10 flight tests in 21 flying hours on the CA-7 by October 14, the first deployed CA-7 test team then headed to Basrah, Iraq, to conduct flight test and evaluation

on Iraqi Air Force CH 2000 and Seabird Seeker aircraft. The team's deployment ended October 19, 2005.¹³

Lieutenant Colonel Stucky subsequently received the Lieutenant General Bobby Bond Memorial Aviator award for 2005, which recognized an AFMC military rated crew member for outstanding contributions to the command's test and evaluation mission while performing aerial duties. The award citation noted that he had deployed his team to a combat zone only 19 days after receiving orders, completed 35 flight test missions while occasionally coming under small arms fire, and returned safely 26 days later.¹⁴

Lieutenant Colonel Stucky briefed on the CA-7 at AFMC between October and December 2005. Stucky called the CA-7 "barely adequate" for its proposed mission and recommended the Comp Air project be abandoned and a substitute found. AFMC was unwilling to cancel the project at that time. When pressed for recommendations, Lieutenant Colonel Stucky advised AFMC Comp Air project lead Colonel Mark Atkinson of several, successively less-desirable, courses of action. Stucky's proposals included fixing all the CA-7 aircraft at Edwards AFB, fixing half the aircraft at Edwards and half at Kirkuk AB, or fixing all six remaining aircraft at Kirkuk AB. Stucky felt that the CA-7 was a "one-of-a-kind aircraft" that could only be fixed safely in the U.S. Due to the "lead time required to procure new aircraft," Colonel Atkinson's recommendation to General Carlson called for modifying one aircraft at Edwards AFB and the remaining CA-7s at Kirkuk AB. In Stucky's opinion, AFMC adopted the next-to-worst compromise.¹⁵

Air Force Flight Test Center commander Major General Curtis M. Bedke refused to concur with the AFMC plan. He pointed out the aircraft had "significant adverse flight characteristics, ill-advised and unauthorized after-market modifications, and numerous aircraft grounding maintenance issues." If the aircraft were modified, Major General Bedke firmly backed Lieutenant Colonel Stucky's recommendation to modify all of them at Edwards AFB, since "each of these aircraft is kit-built and each one has been uniquely modified. Fixing

one at Edwards will not give us the template for the others.”¹⁶ Hand built without any certification or military specifications, each aircraft was essentially unique.

The decision to continue the CA-7 project in spite of Lieutenant Colonel Stucky’s recommendations highlighted the urgency and value for the war effort of constituting an Iraqi Air Force. It also revealed a gulf between Air Force expectations of procuring, testing, and fielding fleets of mass-produced aircraft versus the unsystematic realm of homebuilt aircraft like the CA-7s. The idea that each CA-7 was distinctly different was alien to the Air Force experience of acquisition.¹⁷

Phase II: CA-7 Modification and Repair

After deciding to continue the project, AFMC immediately issued a tasking order for the next phase of the CA-7 program. The tasking allotted just 21 days for a second team to tear down and modify one CA-7 at Edwards AFB, conduct a functional check flight to test those modifications, and create standardized kits with which to refurbish the remaining aircraft at Kirkuk AB. The second team would then deploy to Kirkuk AB, reassemble the CA-7 aircraft modified at Edwards AFB, and modify the remaining aircraft using the kits. The final step would be to test the modified CA-7s. The tasking order allotted 101 days and a budget of \$1.7 million for this second phase, which Lieutenant Colonel Larson likened to operational test and evaluation (OT&E) since it also included training the pilots who would instruct the Iraqi Air Force in flying the CA-7s.¹⁸

Returning the CA-7s to flight required the expertise of both maintenance and flight test professionals. The second deployed team on the CA-7 project combined specialized Combat Logistics Support Squadron (CLSS) maintenance professionals from the Air Force’s air logistics centers with flight test experts from AFFTC and 412 TW. While the CLSS teams usually performed aircraft battle damage repair, AFFTC personnel did not usually repair or modify aircraft to the extent this project required.¹⁹



Phase II test team. Back row, left to right: Lieutenant Colonel Michael E. Pelletier, Major Gary Eilers, Dean van Oosterhout, Technical Sergeant Kevin Call, 402d Maintenance Wing (MW), Robins AFB, Georgia, Technical Sergeant Otto McElvain, Staff Sergeant Michael R. Reed, 76th Maintenance Wing, Tinker AFB, Oklahoma, and Chief Master Sergeant William A. Ludwig. Front row, left to right: Second Lieutenant Todd Rotramel, Staff Sergeant Eric Nanni, 402 MW, Technical Sergeant Robert Saenz, 309th Maintenance Wing, Hill AFB, Utah, Technical Sergeant Vicente Tello, 76 MW, Technical Sergeant Jamie Brown, 402 MW, Master Sergeant Richard Fujimoto, 402 MW, and Technical Sergeant William Koftinow, 309 MW, with a restored, repainted CA 7, Kirkuk AB, Iraq, August 9, 2006. (Photo courtesy of Capt Todd Rotramel)

Lieutenant Colonel Michael E. Pelletier, the 412th Maintenance Group deputy commander, led Phase II. As an aerospace engineer with experience in OT&E and a former president of the Experimental Aircraft Association's Edwards AFB chapter, Lieutenant Colonel Pelletier also had kitplane experience and volunteered eagerly for the deployment. His background gave Pelletier a valuable perspective because he understood maintenance, flight test and evaluation, and the peculiarities of homebuilt, general-aviation aircraft. Flight

test engineer Captain Mike Kelly was assigned to the team from the 419th Flight Test Squadron, along with Second Lieutenant Todd Rotramel from the 412th Electronic Warfare Group, and First Lieutenant Mike McGee, the team's project manager, from the 412 TW's Project Management Directorate. Assigned from the 412th Maintenance Group were Chief Master Sergeant William A. Ludwig, Technical Sergeant Otto McElvain, and Dean van Oosterhout, another kitplane owner. The rest of the team came from AFMC's air logistics centers. The Phase II test team first assembled and met at the Comp Air manufacturing facility between February 19 and 24, 2006. There they familiarized themselves with the CA-7 aircraft and with homebuilt construction techniques. Meanwhile, the lone CA-7 aircraft intended for modification at Edwards AFB left Kirkuk AB on a C-5 on February 15 and arrived on February 22 with its wings and cowling removed.²⁰

Teardown of the CA-7 transported to Edwards AFB revealed even more deficiencies than Lieutenant Colonel Stucky and his team had discovered in Kirkuk. According to project engineer Fred Webster, the team found "the rudder cables running through the center console, zip-tied to all the power cables, so the rudder was moving against the power cables." The location of a header fuel tank in the engine compartment, moreover, appeared to create a fire hazard if the aircraft were to experience a hard landing. This header tank constituted just one of many major modifications made to the aircraft after they left the Aero Comp Inc. facility for the UAE.²¹

Another of the major modifications to the CA-7's original design the team discovered included a steerable nose gear adapted from a Cessna 310. Homebuilt aircraft, built to no particular standard, lent themselves to such unproven modifications. Since the aircraft were not certified, the customer could make any changes to the design he saw fit. This underscored how different kitplanes were from Air Force standards. According to Lieutenant Colonel Pelletier, the installation of the nose gear had required boring more "holes in the firewall for the steering cables to pass through, because the cables go from under the cowl into the cockpit area." As

installed, the modified, steerable nose gear caused unexpected problems in the air. The nose wheel slewed from side to side in flight, while airflow around the nose wheel and weak centering springs in the nose-wheel steering system caused unexpected yaw. This required the pilot to make continual corrections to keep the aircraft pointed in the intended direction of travel. The aircraft had originally been built with a castering nose wheel mounted to the engine mount, a simple yet effective design. The team purchased new engine mounts and castering nose wheels from Aero Comp Inc. to solve these problems on all the CA-7s they refurbished, which Fred Webster called “a pretty big modification.”²²



Engine mechanic Dean van Oosterhout and maintenance team lead Chief Master Sergeant William A. Ludwig working on the CA-7 nose gear during the Phase II deployment, July 17, 2006 at Kirkuk AB, Iraq. (Photo courtesy of Captain Todd Rotramel)

Lieutenant Colonel Pelletier consulted with local flight test and kitplane experts in the area around Edwards AFB to form an Independent Review Team (IRT) for advice on modifying the CA-7. One IRT member, retired AFFTC flight test engineer

Bob Hoey, made recommendations based on his experience with constructing and flying experimental airplanes of similar size and complexity. The throttle was one area in which his expertise proved useful. The CA-7 pilots had reported finding the throttle too stiff, and the Edwards maintenance team had been unsure how much friction there should be in the throttle. They redesigned and rebuilt the gearing plates based on Hoey's recommendations. By April 21, 2006, the team had completed modifications at Edwards AFB. They had not only restored the CA-7 to the original design configuration it was in when it initially left the Aero Comp Inc. factory for the UAE but also completely overhauled it.²³

At this time CENTAF began to add additional requirements, including work on the forward-looking infrared (FLIR) system and air conditioning, which increased the cost and schedule of Phase II. The team also decided to improve the safety of night flying capabilities with the addition of landing and taxi lights. Ultimately, the original 21-day schedule AFMC had planned proved impracticable. The subsequent delay was in part because of the immense amount of work required to modify the aircraft, the increasing requirements, and because Aero Comp Inc. could not produce replacement parts quickly enough.²⁴

The maintainers and engineers redesigned, revamped, or modified a number of the CA-7 aircraft's systems at Edwards AFB. Lieutenant Rotramel documented changes to virtually every system on the aircraft in a modification book. This allowed the team to replicate the changes to the CA-7s at Kirkuk AB and instruct the Iraqi Air Force maintainers on the new systems.²⁵

The team tested the refurbished CA-7, dubbed tail number 2240, between April 25 and May 22, 2006. Phase II test pilots for the flight test at Edwards AFB included Lieutenant Colonel Stucky as the Instructor Pilot and Captain Gary "Spoofe" Eilers from the 419th Flight Test Squadron as lead test pilot. Lieutenant Colonel Nils Larson, 412 OG deputy commander, was the third test pilot, selected because of his experience in flight testing the Schweizer RU-38 Twin Condor for the U.S.

Coast Guard. Major Charles Stuart Farmer of the AFFTC's Safety Office, who had experience with the small, turboprop-powered Beechcraft T-6 Texan II, was the fourth member of the test pilot team.²⁶

The CA-7 test pilots at Edwards had mixed reactions to the aircraft. Major Farmer identified problems with the handling qualities. "The big thing I remember is we didn't push the airplane too far into any sort of deep stall." He also remarked that the CA-7 aircraft had "fairly heavy stick forces. It wasn't a particularly maneuverable airplane." Major Farmer noted that the CA-7's roll forces were high. "Trying to get the airplane to maneuver around or point the airplane [in] a different direction" required "a lot of horsing around." In addition, he found the engine's power response required constant monitoring, since it was "very non-linear," so a small input "could result in a big power change." Lieutenant Colonel Larson echoed this observation, saying that having to "watch how you were adding power" left him feeling he "almost needed a second person to play the part of a flight engineer in the cockpit." He also recalled that although the CA-7 was fun to fly, he was "never really sure what was going to happen next" during a sortie.²⁷

These problems notwithstanding, Instructor Pilot Lieutenant Colonel Stucky believed the Phase II maintenance team had improved the CA-7's handling qualities compared to the unmodified aircraft he had flown at Kirkuk AB in October 2005.²⁸

Despite improvements, flight test revealed a persistent problem with the throttle control that would shortly prove critical. On April 29, 2006, Lieutenant Colonel Stucky was conducting a check ride with Captain Eilers in the modified CA-7 over Rogers Dry Lake. They had maneuvered the aircraft downwind for a touch-and-go landing on the main runway. The throttle lever had always had a great deal of friction, and the pilots had continued to adjust the level of force needed to move the lever. What they did not realize was that they were unscrewing the mechanism. This time, Eilers accidentally unthreaded it completely. When he pulled the power back,

the throttle lever knob came off in his hand. Unfortunately, Captain Eilers had already pulled the power back to idle. As Instructor Pilot, Stucky decided not to take over control of the aircraft from Eilers, as “this would be a great confidence builder for him. I just thought, we were pointed right at the lakebed, and we could really put it down anywhere. I figured we could make the runway.” Captain Eilers declared an in-flight emergency and turned the CA-7 180 degrees to land. After Captain Eilers isolated the fuel system and manually reduced the fuel flow to the engine prior to landing, “the engine totally quit,” leaving the aircraft to roll quietly to a stop on the runway. The pilots jumped out and began to push the aircraft to the taxiway until the maintainers arrived to tow it away. The maintenance team thereafter remanufactured the throttle to add deeper threading (of an inch rather than a half-inch) and a castellated nut secured to the end of the throttle shaft with a cotter pin to prevent the difficulty from recurring.²⁹



AFFTC commander Major General Curtis M. Bedke and Captain Gary Eilers conduct a pre-flight inspection of restored CA-7 aircraft number 2240 at Edwards AFB. Major General Bedke flew the CA-7 on May 15, 2006. (USAF photo by Bobbi Zapka)

The project had a high profile. AFMC commander General Bruce C. Carlson visited Edwards AFB in early April 2006 and inspected the team overhauling the aircraft in Hangar 1600. AFFTC commander Major General Bedke flew the refurbished CA-7 with Captain Eilers on May 15, 2006.³⁰

Despite the attention of senior Air Force leaders and the efforts of the maintenance team, the CA-7s would never become an easily-maintainable, standardized fleet. As Major Sei noted, Air Force leadership was unfamiliar with homebuilt aircraft and “had a lot of assumptions from dealing with highly-engineered, highly-designed, highly-reviewed, certified airplanes.” Air Force aircraft procurement had more rigorous rules, specifications, and performance requirements than the homebuilt aircraft industry. Unlike the typical kitplane, military and certified civilian aircraft came with detailed flight manuals. Military pilots shared best operational practices between units.³¹

The philosophy of the kit’s manufacturer helped explain this difference. The less formal the building process, the greater the variance between finished aircraft. Aero Comp Inc.’s philosophy, according to Lieutenant Colonel Pelletier, was not to “hold the builders’ hand through the process the way that other home-built companies do. I think the reason for a lot of the variations was their builder’s manual and their instructions to the builders were not as precise.” Since no two CA-7 aircraft were alike, the challenge was “to do the best we could, given the raw materials that we were provided,” said Pelletier. As Lieutenant Rotramel observed, “We were trying to make a fleet out of a bunch of one-off airplanes.”³²

Following completion of the flight test of the modified CA-7, the Phase II team deployed from Edwards AFB to Kirkuk AB to repair and test the remaining Iraqi Air Force CA-7s. An advance team arrived on June 9, 2006. The remainder of the test team followed with the refurbished CA-7 and flight test equipment around June 18, 2006.³³

Lieutenant Colonel Pelletier described the design, repair,

and modify phase at Kirkuk AB as “a mini-depot operation,” in which the team “literally took the airplanes down to nothing... to a bare shell” sitting on support stands and then rebuilt each one.³⁴

As the second team began to tear down the remaining CA-7 aircraft, they discovered even more problems at Kirkuk AB than they had at Edwards AFB. The horizontal tail surfaces on the CA-7s had an inconsistent airfoil shape. Some of the horizontal tail surfaces had a very high camber and produced positive lift, while others produced negative lift.³⁵



Staff Sergeant Michael R. Reed works in the CA-7 cockpit at Kirkuk AB, Iraq. (Photo courtesy of Captain Todd Rotramel)

In addition, the installation of an after-market fire suppression system had compromised the aircraft firewalls, as Major Sei had earlier noted. Lieutenant Colonel Pelletier described the installation as a “cobbled-together” system of stainless steel tubing rigged to a fire extinguisher, which had “involved drilling some holes in the firewall in order to pass the lines through.” Some of the holes lacked grommets or other

sealants. He believed the installation posed a potential flight hazard because the compromised firewall might not prevent flames from an engine fire from entering the cockpit.³⁶

The composite construction of the CA-7 and haphazard manufacturing of replacement parts meant that the maintainers could not treat them as interchangeable. Quality control in the manufacturing of replacement parts seemed sorely lacking. This became evident in the team's attempt to replace the wings on aircraft 2249. The replacement wings and their critical load-bearing internal structures were so misshapen that the CLSS team could not properly align them to the aircraft's fuselage. Moreover, one new wing weighed 90 pounds more than the CA-7's original wing. Another replacement wing had a large gouge in the mounting bracket and required an assessment by lead engineer Fred Webster before use.³⁷

Lieutenant Colonel Larson confirmed that "whenever we would try to mod these airplanes... there were no standards" for the replacement parts. He described the experience of the Phase II team trying to swap out a flap. They found the first spare flap did not fit. They tried another flap, which did not fit either. Finally they resorted to modifying a replacement flap to fit the aircraft. Larson argued the CA-7s would require flight test throughout the aircraft's life, because "every time you change a part, the aircraft is different."³⁸

Flight test began in Kirkuk about 10 days after the Phase II team arrived at Kirkuk AB. The first sortie was a functional check flight on June 29, 2006, of CA-7 number 2240 modified at Edwards AFB. The lead test pilot was Major Eilers, assisted by flight test engineer Captain Mike Kelly and an Iraqi Air Force pilot. The team reported a successful flight, except that the forward-looking infrared system (FLIR) system caused smoke to enter the cockpit. The first flight of a CA-7 aircraft refurbished in Iraq, designated YI-125 or aircraft number 2247, took place on July 15, 2006.³⁹

The Phase II team found additional problems with the CA-7's after-market engines. A company named Diemech

Turbines had altered the M601 engines originally built by Walter Engines. Much like the aircraft themselves, these engines came with no warranty, documentation, or maintenance records.⁴⁰

Several members of the maintenance team worked to improve the engines' performance, including solving several engine overheat issues. Dean van Oosterhout and Technical Sergeant Otto McElvain installed engine baffle kits on the aircraft. McElvain, van Oosterhout, and Technical Sergeant William Koftinow also added National Advisory for Committee Aeronautics (NACA)-style scoops to the engine cowlings, forcing more cooling air through the engine. Technical Sergeant McElvain designed throttle cable brackets and had the Edwards maintenance backshop fabricate them. The brackets reduced friction in the throttle cable and linkages, allowing more precise throttle control.⁴¹

Lieutenant Colonel Pelletier particularly drew attention to the contributions of Dean van Oosterhout, whose expertise as an engine mechanic included both Airframe and Powerplant certifications, and who also owned a kitplane. In addition to his work on engine performance, van Oosterhout also applied his skills to teaching both the Americans and Iraqis how to safely and effectively operate the engines.⁴²

Despite the team's efforts, the larger and more powerful engines proved too problematic. The CA-7s had been designed for a smaller piston engine with lower horsepower. The UAE had substituted larger 600-horsepower turboprop engines but had not changed any of the control surfaces or control-surface throws. The substituted engine's large propeller tended to destabilize the airplane in pitch and yaw.⁴³

The fact that flight test revealed different engine performance between airframes troubled the Phase II team as well. The aircraft modified at Edwards AFB (aircraft number 2240) demonstrated a climb rate of 800 feet per minute, while the first CA-7 modified at Kirkuk AB (aircraft number 2247) had a climb rate of 1600 feet per minute. Without engine

modification and maintenance records, the team had no way to explain this dramatic difference in performance. They could not tell whether the issue stemmed from imminent failure of the first engine, or if the second simply had more power.⁴⁴

As Lieutenant Colonel Pelletier's team began preparing to clear the CA-7s for return to flight, test revealed the aircraft to have different flight characteristics than previously encountered at Edwards or Kirkuk AB. On July 22, 2006, Major Eilers*, Major M. W. "Raisin" Cain II, USMC, commander of the local Military Transition Team (MiTT), and Captain Kelly took off on a routine flight test sortie to fine-tune the stall vane positioning and aileron fixed trim tab on CA-7 number YI-125 (tail number 2247). Major Cain had the stick and was conducting a power-on stall at high power and 6750 feet above ground level (AGL). The nose drifted to the left and Major Cain countered with right rudder. When the



Phase II team lead Lieutenant Colonel Michael E. Pelletier at Kirkuk AB. (Photo courtesy of Captain Todd Rotramel)

* Gary Eilers received promotion to Major effective June 1, 2006

aircraft suddenly yawed to the left, Major Cain attempted to recover the aircraft by relaxing the aft stick while applying slight forward stick. When the aircraft continued its left yaw, “departed controlled flight and developed into a stabilized, upright, left spin,” Major Eilers pulled the power to idle, and exchanged control of the aircraft with Major Cain. Major Eilers then verified that flight controls were neutral. He applied right rudder after the first revolution to no effect, then again neutralized all flight controls but the rudder. Upon the second revolution, Eilers pulled the control stick aft, then pushed it forward, but again noted no recovery. With the aircraft having completed four revolutions and now at an altitude of 4500 feet AGL, Eilers again neutralized the flight controls. After the fifth revolution, Major Eilers applied the rudder in the direction of the spin. He finally recovered the aircraft at an altitude of about 2500 feet AGL.⁴⁵

These issues raised doubts about the airworthiness of the aircraft, and the team never flew the CA-7s again.⁴⁶

Lieutenant Colonel Pelletier decided to call a halt to the CA-7 project shortly after Major Eilers reported his experience with the spin in aircraft 2247. In August 2006 he resolved not “to put another pilot at risk. So I made the decision it was time to make the recommendation to ground” the CA-7s. He called the 412 TW commander, Colonel Arnold W. Bunch, Jr., and his words were, “Michael, I support you 100 percent.” Major General Bedke, the AFFTC commander, concurred with the recommendation. The AFMC commander and the Air Force Chief of Staff agreed.⁴⁷

The Phase II test team departed Iraq on August 14, 2006, after 58 days, having modified four CA-7 aircraft, and conducted 23 sorties in 45 flying hours. This ended AFFTC’s involvement in reestablishing the Iraqi Air Force and in deployed flight test.⁴⁸

In spite of the high-level interest in reconstituting an effective Iraqi Air Force with the CA-7 aircraft as quickly as practicable, the data gathered in flight test compelled both

Lieutenant Colonel Stucky and Lieutenant Colonel Pelletier to recommend against fielding the CA-7. Despite the overhaul of the aircraft, Lieutenant Colonel Pelletier could not vouch for the CA-7s or their engines.⁴⁹

Despite the wartime urgency, Lieutenant Colonel Larson believed that flight test had demonstrated that a decision to field the CA-7 was too risky. While accepting risks in flight test made sense in some situations, he believed the CA-7 was not one of them. “A lot of times we do that because it’s combat. It’s war. We’ve got to field this.” In his experience, however, programs like the CA-7 that were “not high-dollar... take on a life of their own, even when they have issues.”⁵⁰

Combat Flight Test

Conducting flight test in a combat environment meant radical changes from the usual way of doing business at AFFTC. As described above, two separate teams had deployed to work on the CA-7 project at Kirkuk AB. Both teams operated in an austere combat environment without the standard resources, equipment, and personnel of a normal flight test operation. The CA-7s lacked the data-collection instrumentation typically installed on an aircraft under test. The aircrews competed with combat missions for access to airspace, which in any event was not calibrated like the test range at Edwards AFB.

Packing and transporting the materials they might need in Iraq proved to be a challenge. Obtaining sufficient shipping containers to securely transport their tools and spares took several weeks. The maintainers removed the wings of the CA-7 aircraft that had been refurbished at Edwards and crated it for shipping. They assembled all the refurbishment kits they anticipated requiring for repair and modification of the remaining aircraft in Kirkuk, and all the replacement parts, tools, and equipment they expected to need. Maintenance team lead Chief Master Sergeant Ludwig then called in “all of his markers trying to get it all on a C-17,” according to Fred Webster. Forgotten was one replacement fuel tank they had

planned to take. The team often overcame such supply chain challenges with a twice-weekly commercial delivery of parts from the U.S.⁵¹

Individual team members also had to decide what to bring. Major Vincent Sei observed, “The airplane dumps you off on the ramp, and everything you brought you have to move yourself. So you start making choices. At the time we were going to Iraq, it was a hundred degrees. Do you think you’re going to need a thirty-pound sleeping bag? That’s going to stay in your garage at home.”⁵²

Security was a concern and required precautions during flight test sorties in the combat zone. CA-7 aircrew wore body armor and carried weapons on board the aircraft. Lieutenant Colonel Pelletier remembered the cockpit as fairly tight, made more so by body armor and a parachute. As a result, he said, “our pilots were kind of uncomfortable.” Pilots flew tight patterns during touch-and-go landings to stay within the confines of the airfield at Kirkuk AB. They planned and executed random approaches in order to avoid small arms fire. According to Lieutenant Colonel Stucky, “we tried to always go up as a two-ship” formation with a contingency plan in case of an emergency landing. Despite their precautions, Lieutenant Colonel Stucky reported his team still suffered “one bullet strike on a propeller.”⁵³

Deployment had hazards on the ground as well. To provide some protection from frequent rocket attacks on Kirkuk AB, base personnel kept their body armor close at hand. Both Lieutenant Colonel Stucky and Major Sei of the Phase I team admitted they initially neglected this safety measure because of the high temperatures they worked in. Major Sei heard explosions one night while in quarters. As the rockets detonated closer, the officers realized their personal protective gear was still in the truck outside and resolved to be more diligent from that point forward.⁵⁴



Flight test engineer Major Vincent “Opus” Sei and test pilot Lieutenant Colonel Andy White preparing for a sortie at Kirkuk AB, Iraq. Although all were qualified on the standard-issue M4, deployed Phase I testers often chose to carry the small, lighter AK-47 in the close confines of the CA-7 cockpit. (Photo courtesy of Dean van Oosterhout)

Phase II team members wore body armor when moving around the base and kept their M4 carbines secured nearby. Lieutenant Colonel Pelletier and Lieutenant Rotramel chose to carry their M9 sidearms at all times. Pelletier frequently observed tracer fire arcing through the sky outside the base perimeter. On one occasion, while at the base dining facility, Pelletier saw a large explosion just outside the base entry gate, powerful enough to shake the building and force all base personnel to take shelter. The evening before the Phase II team departed, enemy forces attacked the oil pipeline running north of the base. The resulting fire sent heavy, black, oily smoke drifting over the base.⁵⁵

The natural hazards of the deployed environment also came a little too close for comfort. Lieutenant Colonel Pelletier

and Lieutenant Rotramel shared office space in a hangar with a mouse, which Lieutenant Colonel Pelletier refused to displace. One day while returning to the office, Pelletier saw the lieutenant rush out of the building, kicking a box in front of him. Rotramel had noticed an intrepid mouse-hunting Kurdistan viper, the most poisonous snake in Iraq, coiled up behind Lieutenant Colonel Pelletier's chair.⁵⁶

To provide physical and operational security for the project, the Phase II team worked from an isolated, hardened aircraft shelter at the north end of Kirkuk AB. This produced security challenges not usually encountered in flight test at Edwards AFB. The shelter was open at both ends. One end faced the base perimeter road, beyond which lay a fence and a large open field frequented by local Iraqi shepherds and farmers. The team had no way to know who was or was not friendly, and they did not want the civilian population to know the details of their work on the CA-7 aircraft. Lieutenant Colonel Pelletier directed Captain Kelly to work with base civil engineers to build a protective berm from Hesco bastions. When filled with dirt, these defensive barriers constructed of wire mesh and fabric provided protection from small arms fire and shrapnel, which eased the team's security concerns.⁵⁷

The lack of the usual instrumentation and test equipment forced the 412 TW's testers to improvise. Chief Ludwig had ordered aircraft scales to perform center-of-gravity (CG) tests, but the scales initially failed to arrive at Kirkuk AB. The team commandeered 100 pounds of free weights from the base gym and eleven pallets of plastic water bottles from base supply in order to conduct the CG tests.⁵⁸

In conducting ground and flight test on an uninstrumented aircraft like the CA-7, testers used handheld instrumentation to record control forces and control deflections. Miniature cameras mounted in the cockpit recorded video and audio on a one-of-a-kind, "battery-powered instrumentation pallet" the team strapped into the rear seat as a substitute for the usual test instrumentation. Engineers used surgical tubing to put pressure on the pitot-static system to check for leaks.⁵⁹



Dean van Oosterhout setting up for a center-of-gravity test in the CA-7 aircraft during Phase I in Kirkuk, October 11, 2005. (Photo courtesy of Dean van Oosterhout)

In the end, deployed flight test relied on classical flight test techniques. The CA-7 flight test was based on methods developed in the 1930s and 1940s, taught in engineering classes and by USAF Test Pilot School, but no longer used on modern fly-by-wire jet aircraft instrumented for flight test. Fred Webster had read about these techniques but never used them. He discovered in conducting flight test, “old school does work.” In presentations at the annual symposia of the Society of Experimental Test Pilots and the Society of Flight Test Engineers, both Lieutenant Colonel Stucky and Major Sei expanded on this notion. They argued that the Air Force needed “to retain a core capability for conducting classical flight test using portable instrumentation packages and hand-held data” collection using such old standbys as cockpit instruments, a timer, and a kneeboard.⁶⁰

Not surprisingly, given that flight test operations took place in a war zone, both Lieutenant Colonel Stucky and Lieutenant

Colonel Pelletier and their staffs were forced to deconflict their test mission with the combat mission of Kirkuk AB. Takeoff times required constant communication with the control tower, for instance, and usually netted only a short time frame in which to accomplish the sortie. Both teams had to call for aviation fuel trucks well in advance of a sortie, occasionally experiencing delays as combat sorties took precedence.⁶¹

Deployment to Kirkuk AB also obliged them “to do a lot of horse-trading, begging, and scrounging” for necessities. Lieutenant Rotramel remembered, “We didn’t always get the support we needed from the base, so if we needed something we had to go do it ourselves... whether it was giving us a phone, or giving us radios to use, or a vehicle to drive, or even a place to stay.”⁶²

Despite the inconveniences and hazards, the deployed teams had more autonomy and responsibility than usual. The members of a small deployed team provided the instrumentation, control room, data analysis, and aircraft maintenance normally provided by other personnel at Edwards AFB. Major Sei appreciated being able to make decisions without having “someone looking over your shoulder.” The deployed environment allowed the team to “apply common sense and judgment on how you’re going to do flight test deployed operations.” Lieutenant Colonel Stucky remarked that “They really empowered us to do our jobs,” which led to success in the field. His team “never had a cancelled flight nor ever came back Code 3*. It was nice to get a short waiver from Murphy’s Laws of flight test.”⁶³

Conclusion

The attempt to return the CA-7 kitplanes to flight for use by the Iraqi Air Force demonstrated all aspects of a typical flight test program, only more compressed in schedule.

* Code 3 refers to a severe problem with an aircraft that affects mission accomplishment and safety and requires repair before returning to flight.

The project illustrated the types of tasks a flight test program entailed. These included securing funding, determining the appropriate aims and scope of the flight test program, ensuring the safe conduct of flight test at Edwards AFB and Kirkuk AB, and collecting data to support a final recommendation. Conducting flight test in an austere, deployed location was an added complication.

The CA-7 project proved that personnel of AFFTC and 412 TW could conduct flight test wherever and whenever needed, using whatever tools and resources were available. Despite the hazards of the deployed environment and the lack of proper equipment, the flight test professionals accomplished their mission in accordance with the test plan and on schedule.⁶⁴

The deficiencies the flight test teams discovered on the CA-7s also demonstrated clearly the utility of a thorough flight test program. The CA-7 aircraft tested lacked both construction and maintenance records. The UAE had made a number of after-market modifications to the aircraft's design and systems that had not been systematically tested. Lieutenant Colonel Stucky sounded a cautionary note on the kinds of changes to "the basic systems design of the aircraft" and argued that virtually every one of the after-market modifications had serious consequences," which the UAE "did not properly anticipate."⁶⁵

Lieutenant Colonel Pelletier endorsed the flight test process, if not the CA-7. He considered the CA-7 project a success because AFFTC had followed proper flight test procedures, gathered data, and used the results to make a decision.⁶⁶

Calling a halt to the CA-7 project was not easy given the project's high priority and visibility. To many of the participants, however, the CA-7 project illustrated the importance in flight test of "sound engineering judgments" as the basis for decision-making.⁶⁷

NOTES

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Glossary

AB	Air Base
AFB	Air Force Base
AFFTC	Air Force Flight Test Center
AFMC	Air Force Materiel Command
AGL	Above Ground Level
Brig Gen	Brigadier General
CA-7	Aero Comp Inc., Comp Air 7SLX aircraft
Capt	Captain
CENTAF	U.S. Air Forces, U.S. Central Command
CG	center-of-gravity
CLSS	Combat Logistics Support Squadron
COA	course of action
CMSgt	Chief Master Sergeant
Col	Colonel
EAA	Experimental Aircraft Association
FAA	Federal Aviation Administration
FCF	functional check flight
FLIR	forward-looking infrared system
FTE	flight test engineer
IFE	in-flight emergency
IP	Instructor Pilot
IRT	Independent Review Team
Lt	Lieutenant
Lt Col	Lieutenant Colonel
Maj	Major
Maj Gen	Major General
MiT	Military Transition Team (USMC)
MXG	maintenance group
MW	maintenance wing
NACA	National Committee on Aeronautics
OG	operations group
POC	point of contact
RTO	Responsible Test Organization
T&E	test and evaluation
TPS	USAF Test Pilot School
TSgt	Technical Sergeant
TW	test wing
UAE	United Arab Emirates
UON	urgent operational need



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